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AUTHOR Zuniga, Robin Etter; Johnstone, Sally M.
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ABSTRACT

This paper examines the design and findings of a survey of 31 faculty and 550 students participating in 7 Annenberg/CPE New Pathways to a Degree electronic learning projects. Each project was selected because it proposed innovative ways to use technology to create new educational opportunities for "new majority learners" (students unable to attend college in conventional ways). All New Pathways courses used technologies in combinations, and communication between students and instructors and among students was supported via several technologies. Survey results indicated that off-campus students found delivery of lectures via video technology (two-way video, one-way video with two-way audio, broadcast video, and videotape) to be acceptable. Students felt that the quality of their mediated interaction with their instructor was as good as or better than experiences in face-to-face classes, and half the students felt that the frequency of their interactions were the same or more frequent. To promote interaction between faculty and students or among students, technologies such as audio-conferencing, electronic mail, or voice mail were more effective than video technologies. Faculty felt that the technologies that let them act the same way they do in face-to-face classes provided the best tools for interaction. The technologies are pushing changes in the relationship among course content, mentor, and student. (Contains 18 references.) (JDD)

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New Pathways to a Degree:

An Assessment of the Use of Instructional Technologies

at Seven Institutions

Abstract:

Most higher education institutions have invested, to at least some degree, in learning technologies that open the campus--from computers to satellites. However, we know very little about whether the benefits of these technologies justify their cost to institutions (e.g., How do they affect a student's ability to learn, to perform in the learning environment, or to attain educational goals?) This paper reviews the two-year evaluation of the seven Annenberg/CPB New Pathways to a Degree electronic learning projects. The evaluation's design and findings will be discussed; and the applicability of the evaluation design to other institutions and lessons learned about evaluating technology based learning programs will be examined.

Robin Etter Zúñiga
Sally M. Johnstone

Association for Institutional Research
1994 Annual Forum
New Orleans, June 1, 1994

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for Management Research, Policy Analysis, and Planning

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Jean Endo
Editor
Forum Publications

American business and industry, in urban or rural settings, must find new ways to constantly increase and reinforce the skills of their employees. The enormous complexity of modern technology and the speed at which new innovations arise makes career-long training a necessity (Baldwin, 1991; see also Reich, 1991b; Commission on the Skills of the American Workforce, 1990). The inflexibility of the traditional university schedule, however, often presents a hardship for this clientele (Hall, 1991; Carey, 1991).

The use of new technologies plays an important role in higher education's overall strategy for meeting the needs of rural communities, and the life-long learning needs of the workforce. Through the use of telecommunications and computers institutions of postsecondary education have found new ways to deliver courses to the "new majority learner". Moreover, studies conducted on the instructional benefits of electronic learning technologies suggest that they have the potential for changing the relationship between teacher and student. Telecommunicated discussions and computer simulations put everyone on a more equal footing regardless of assertiveness, or physical, regional, and cultural differences. Moreover, learning becomes a process of understanding and application rather than memorization, in which students are transformed from passive receptors of knowledge to active participants in the learning process, and the instructor becomes a mentor or facilitator rather than a purveyor of knowledge (Kozma and Johnston, 1991; Johnstone, 1991).

If the full potential of these technologies is to be realized, however, many issues remain to be resolved. First, while there are many excellent examples of innovative instructional programming, computers and telecommunications are not being used to their full potential in the classroom. While higher education institutions have invested heavily in telecommunications and computing equipment, the teaching process has not changed to take advantage of these technologies, and only a small proportion of the faculty use technology in instruction (Kozma and Johnston, 1991; Carey, 1991). Second, questions remain to be answered regarding the effectiveness of computer-aided learning modules and telecommunications in instructional programs. It is not clear from the available research, which focuses on academically advanced and highly motivated students, whether these technologies succeed as well with "at-risk" and less motivated students. Moreover, while students give telecommunicated courses high marks, the majority say they prefer to take classes where they meet face-to-face with the instructor and other students (Johnstone, 1991).

The growing interactivity of the medium may shift these preferences somewhat, but more research is needed on the best instructional uses of face-to-face and telecommunicated interaction. Unfortunately, an adequate body of research does not exist on the effectiveness of technology based learning programs. According to Kozma and Johnston (1991), very few of the EDUCOM/NCRIPTAL innovative computer-based learning programs include an assessment plan. There are barely enough resources to support program development, and most faculty involved in these programs are not trained in assessment methodologies. Institutional researchers, through their knowledge of assessment methodologies, can contribute a great deal to our understanding of this area.

This paper reviews the two-year evaluation of the seven Annenberg/CPB New Pathways to a degree electronic learning projects. The evaluation's findings will be discussed, and the applicability of the evaluation design to other institutions and lessons learned about evaluating technology based learning programs will be examined.

New Pathways To A Degree: Overview

The New Pathways to a Degree initiative of the Annenberg/CPB Project provided $1.5 million to seven projects.[1] Each of the funded projects was selected because they proposed innovative ways to use technology to create new educational opportunities for "new majority learners." New majority learners are defined as students with jobs, home responsibilities, busy schedules, and other life circumstances which make it extremely difficult for them to attend college in conventional ways.

The seven projects grouped by major characteristic are:

Multi-institutional projects:

BACCALAUREATE DEGREES AND STUDENT SERVICES: USING THE NEW TECHNOLOGIES TO EXPAND ACCESS, The Oregon State System of Higher Education and Oregon Ed-Net. Its self-stated goal was to develop a model for how schools can offer complete baccalaureate degree programs through a statewide educational network.

PROJECT BREAKTHROUGH, West Virginia Higher Education System, Morgantown. Its self-stated goal was to develop a model for a collaborative statewide coalition that will make undergraduate degree opportunities available to rural adults.

COMMUNITY COLLEGE OF MAINE, University of Maine at Augusta, and the Maine Community College System. Its self-stated goal was to build on its current system of linking all public higher education institutions with off-campus sites such as public schools and off-campus centers to offer a coherent sequence of courses for an associate of arts degree to rural learners in the state.

New Programs, New Populations:

ELECTRONIC ACCESS TO WEEKEND COLLEGE, The College of St. Catherine, St. Paul, Minnesota. Its self-stated goal was to serve as a model for how colleges--particularly those with weekend programs--can use technology to remove educational barriers and meet the needs of the adult student.

COMMUNITY LEARNING NETWORK, Indiana University-Purdue University at Indianapolis. Its self-stated goal was to develop a model for how urban universities can provide access and community support for minority students.

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[1] The Annenberg/CPB Project received 243 proposals of which they were able to fund seven. Because of the broad interest in the project and the high quality of the proposals, the Annenberg/CPB Project decided to support additional related activities and invited 32 of the best applicants to become "New Pathways Associates." The Annenberg/CPB Project conducted on-campus workshops, supported three annual meetings and several electronic discussion groups, which enabled the Associates to join with the funded institutions in the ongoing discussion which surrounded New Pathways to a Degree.

Technological Pragmatists:

ENHANCED ACCESS TO LEARNING THROUGH TECHNOLOGY, Rochester Institute of Technology, Rochester, New York. Its self-stated goal was to develop an affordable model for using technology to offer highly accessible upper division courses to give students even more freedom to choose where, when and at what pace they study.

ACCESS, INVOLVEMENT AND SUCCESS IN DISTANCE LEARNING, The Extended Leaning Institute, Northern Virginia Community College. Its self-stated goal was to use public and cable television, computer conferencing, two-way compressed video, audio conferencing, voice mail and videocassettes to make it possible for students to earn an entire associate degree in general studies or business administration.

The seven funded projects are remarkable in their diversity--both in their organization and in the activities in which they are engaged. Students in one or another of the New Pathways projects used just about every learning technology available:

- Some students participate at home in a course broadcast live from an on-campus classroom. These students can "raise their hands" and participate in the classroom discussion by means of a return video, a return audio signal, or a dial-up telephone.
- Some students learn by video tapes produced on campus or by commercial providers. These video tapes are distributed to students by mail or courier. Students can watch these videos at their own convenience rather than being bound by a specific broadcast time. The students speak to their instructor by toll-free telephone or other means.
- Some students receive courses on a computer at home or at work--the course content is delivered to students as a series of computer files via a computer network. Students interact with the instructor and institution primarily by computer network. E-mail is used to support communication between teacher and students and between individual students, and electronic bulletin boards are used to support one-to-many communications -- teacher to students, and student to students.
- Some students participate in live classes via telephone--several speakerphones are connected to each other by an audio bridge: every participant can hear and be heard by the instructor and by other students connected to the bridge.
- For any of the above models, students may use a remote learning center. The center, usually a dedicated room in a school, library, or community center, is equipped with a large array of communication and learning tools--video monitors, VCRs, fax machines, telephones, computers with modems for connecting a campus network, and computer peripherals like CD-ROM readers,

printers, and so forth. The course may require students to use any or all of these communication devices.

In most of these situations, students meet other students, face to face or electronically, and form learning communities. In all of these modes, students have alternative means of communicating with instructors outside of class hours--by toll-free telephone circuits, voice mail, computer network, fax, mail or combinations of these communication systems.

Each of the New Pathways' projects used a different version of these models. Table 1 offers a glimpse into the range of technologies used at each of the seven projects. It shows the variability between the projects with regard to the varieties of technologies that were available to the students and faculty.

All classes at all of the projects used some form of print media, and most had access to some form of video technology. Electronic mail was also widely available for use by the students and faculty involved in these New Pathways classes. Moreover, all New Pathways courses had two things in common: (1) technologies are used in combinations, and (2) that communication between students and instructors, and among students are supported via several technologies. Assessment of the effectiveness of these projects focused on the effectiveness of course delivery, communication between instructor and students, the degree to which these technologies enabled successful teaching and learning, and how institutions adapted to the service needs of the faculty and students.

TABLE 1
Types of Technology used in New Pathways
by Project

Project	Technologies	
	All NP Classes	Some NP Classes
IUPUI	Print, One-way video, voice mail, videotapes facsimile, e-mail	Videodisc, application software
Maine	Print, one-way video/two-way audio	Voice mail, audioconferencing
Northern Virginia	Print	One-way video, videotape, voice mail, e-mail, two-way video, application software, audioconferencing
Oregon	Print, two-way video or one-way video/two-way audio	E-mail
RIT	Print, videotapes, one-way video, e-mail, audioconferencing	Application software, computer testing, picture phone
St. Catherine	Print, application software, e-mail, facsimile, audiotapes, videotapes	
West Virginia	Print, one-way video/two-way audio, voice-mail	Videotape, e-mail, computer networks

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The Evaluation Process

The Western Cooperative for Educational Telecommunications was selected by the Annenberg/CPB Project to conduct the evaluation of the New Pathways funded projects. The Western Cooperative staff acted as coordinators for individual evaluators who closely followed the seven projects. The evaluation was designed to:

- assess the impact of telecommunicated instruction upon students;
- determine the effect of technology and mixes of technology on student learning, instructional processes, organizational policies, and support structures; and
- determine the overall impact of the program.

In year one of the evaluation, each evaluator made at least one two-day site visit and maintained regular face-to-face and telephone contact with the on-site project teams, other evaluators, and the contractor's staff. They interviewed project staff, faculty, and students and collected baseline information on the project. In addition, each project was asked to complete an environmental scan to help the evaluation team identify the types of data available from individual project sites. In year two, each evaluator made a second site visit. During the site visit they interviewed students, faculty, and project staff about their experiences with and perceptions of the project.

The evaluation process included a survey of a sample of faculty and students from each project. The survey provided additional insights into the anecdotal information collected and supported the generalizations across projects observed during the site visits.

This paper focuses exclusively on the methodology and results of the formal survey evaluation. More information on the conclusions of the full evaluation process can be found in the final project reports: *New Pathways to a Degree: Technology Opens the College* (Markwood and Johnstone, 1994a) and *Seven Technology Stories: New Pathways to a Degree* (Markwood, and Johnstone, 1994b).

New Pathways Faculty and Student Surveys

Evaluators visiting each project heard many comments about how students and faculty worked with these various technologies. To verify anecdotal information about student and faculty experiences gathered from these site visits, surveys of students and faculty were conducted. The following section discusses the survey design and methodology, and reviews the results of the student and faculty surveys.

The student and faculty in the seven New Pathways projects were administered during the Spring 1993 academic term. The student and faculty surveys were designed so that comparisons could be made between faculty and students and across programs and, where applicable, between on-campus and off-campus students.

Sampling.

New Pathways courses at each program were the sampled population. Each of the seven New Pathways projects was asked for a list of the New Pathways courses taught during the Spring 1993 term. These lists included course name and number, total enrollment attending at on-

and off-campus locations (where relevant), and the technologies available for use in the course. Table 1 shows the range of technologies used in the New Pathways courses and the percentage of students with access to each.

TABLE 1
Percent of New Pathways Students with Access to Specific Technologies

Technology	Off-campus students	On-campus students
Videotapes	70%	67%
Audio conferencing	42%	46%
Televised lectures	41%	51%
Electronic mail	38%	20%
Audio talk-back	36%	40%
Voice-mail	29%	19%
Audiotapes	12%	20%
Two-way video	11%	15%
Computer programs	10%	15%

Courses were selected based on their field and discipline, enrollment, and mix of technologies. The goal was to include a representative mix of courses from each program. In programs offering only a few courses, all courses for the Spring 1993 term were included in the sample. Overall, 35 New Pathways courses were sampled (See Table 2). Of these 13 had students simultaneously enrolled on-campus and at off-campus sites.

TABLE 2
Survey of Students and Faculty
Courses Sampled in Spring 1993

PROGRAM	COURSES SAMPLED	TOTAL No. of COURSES
IUPUI	2	2
Maine	6	8
Northern Virginia	11	16
Oregon	3	4
RIT	8	8
St. Catherine	2	2
West Virginia	3	3
TOTAL	35	43

As Table 3 shows, the courses surveyed vary in size from 4 to 304 students. The larger courses tended to be one-way video, two-way audio courses that we refer to as "video with audio talk-back." The smallest courses were computer-based classes.

TABLE 3 Number of Students Enrolled in Sampled Courses	
MEAN	51
MEDIAN	35
RANGE	4 to 304

The technologies used also ranged widely. While all the technologies listed in Table 4 were used in the classes represented in our survey, some classes used more than one technology.

TABLE 4 Technologies used in Sampled Courses		
Specific Technology	Number of Courses	Percent of Students
Videotapes	18	56%
Computer Conferencing	19	48%
Computerized Instruction	13	45%
Televised Lectures	11	35%
Video with Audio Talk-back	9	29%
Voice Mail	8	20%
Two-way Video *	2	11%
Audio Conferencing	9	18%
Audiotapes	2	7%
* one course dropped from analysis due to non-response		

As Table 5 shows there is a wide range of academic disciplines represented by the courses surveyed. Courses were selected across a wide range of disciplines to smooth out the effects specific to particular teaching practices (e.g., mathematics versus literature).

TABLE 5 Percent of Sampled Courses by Discipline			
Humanities	17%	Art/Drama	9%
Science	17%	Health	6%
Social Science	11%	Language	3%
English	11%	Math	3%
Computer	11%	Vocational Education	3%
Business	9%	TOTAL	100%

Student Survey

The student surveys were designed to measure student satisfaction and proficiency levels with, and use of individual technologies; satisfaction with the course, instructor, and support services; and students' academic goals and achievement levels. The full student questionnaire contained 142 questions in 12 individual sections. It was designed to be easily tailored to the types of instructional technologies[2] available for each course. Sections C through K of the survey were included only if the technology asked about was available for use in that course. Individual course questionnaires varied in length from 39 questions, to a maximum of 86 questions.

The survey contained a mix of likert-scale questions and open-ended questions. All students were asked for information about their academic background, general course information and, with the exception of the University of Maine[3], were asked to evaluate their faculty. Students also were asked about their experiences and satisfaction with the specific technologies used in their course and were given the opportunity to comment on the advantages and disadvantages of using each technology. The name of the sampled course appeared at the top of page one of the questionnaire. At several points in the survey, students were directed to answer the questions with this specific course in mind.

The distribution of the student questionnaires was timed so that students would receive them shortly after mid-term. This gave students enough time to be familiar with the course and the technologies used, and to have earned enough grades on assignments and exams to give us informed responses. Since beginning and ending dates, and term length vary across institutions, the timing of the questionnaire distribution was staggered.

Each program took a role in distributing the questionnaires and conducting follow-up. Each program was sent the appropriate number of questionnaires and cover letters for each course sampled. The program office than took responsibility for distributing the questionnaires, conducting follow-up activities, and collecting the responses[4]. Some programs mailed the questionnaires directly to the students, while others sent them to the faculty who distributed them in class or at distance-learning sites. The choice of distribution was up to the program and was based on their perception of the best way to reach their students.

Each of the programs were asked to conduct follow-up activities in order to ensure a high response rate. The particular type of follow-up activity varied across programs depending on the resources they had available. At least two programs sent out reminder postcards or letters to students (Northern Virginia, RIT). Indiana University-Purdue University at Indianapolis (IUPUI) also sent out reminders by mail to one site-based course. In the majority of cases, students were reminded by faculty/proctors at the remote site to complete and return the questionnaire.

The overall project response rate was very acceptable. A total of 1,890 questionnaires were sent to the 7 programs; 552 questionnaires were returned as extra or undeliverable, leaving a total population of 1,338 students. Five hundred-fifty completed questionnaires were returned for

[2] The types of instructional technologies covered in the survey were videotapes, audio conferencing, televised lectures/one-way video, electronic-mail/computer conferencing, video with audio talk-back, vocie-mail, audiotapeds, two-way video, and stand alone computer programs/coursesware).

[3] The faculty union contract at the University of Maine prohibits conducting faculty evaluations without the direct involvement of the faculty in the design of the questionnaire.

[4] Students in the Oregon program were asked to mail their completed surveys directly to the Western Cooperative for Educational Telecommunications.

a response rate of 41.1 percent. Response rates varied across projects, ranging from a 13 percent overall response rate at Indiana University-Purdue University Indianapolis (IUPUI) to a 100 percent response at the College of St. Catherine (see Table 6). Analyses of the total student population and the total distance learning population were weighted to account for these differential response rates.

TABLE 6
Response Rates by Project and Type of Student

	ALL STUDENTS			OFF-CAMPUS STUDENTS		
	Distributed*	Returned	Response Rate	Distributed*	Returned	Response Rate
No. VA	177	105	59.3%	177	105	59.3%
Maine	366	207	56.6%	282	145	51.4%
IUPUI	324	43	13.3%+	31	7	22.6%
West VA	164	86	52.4%	103	50	48.5%
Oregon	107++	51	46.7%	67	27	40.3%
RIT	192	50	26%	192	50	26%
St. Kate's	8	8	100%	8	8	100%
TOTAL	1,338	550	41.1%	860	392	45.6%

* The number distributed is equal to the number of questionnaires sent to the program less those that were extra or undeliverable

\+ The relatively lower response rate for IUPUI is probably due to several factors: (1) students at IUPUI completed 3 questionnaires and a 30 minute interview earlier in the semester and were reluctant to take time to complete another questionnaire; (2) a large on-campus section of one New Pathways course in which the students had little stake in the outcome of the evaluation was included in the IUPUI sample (if this course is excluded the response rate increases to 22.5 percent).

++ One course in the Oregon program was dropped (Anthro 319) from the analysis because questionnaires were not distributed to all students in the course.

Faculty Survey

The faculty survey was designed with crosswalks to the student survey. Faculty were asked comparable questions about their satisfaction and perceived proficiency levels with individual technologies; satisfaction with available support services; perceived differences between dynamics in distance learning and regular classroom settings; and the effect of involvement in distance learning curriculum on their career development. They also were asked to answer select questions about their academic and professional background taken from the National Center for Education Statistics' *1992 National Survey of Postsecondary Faculty* (NCES, *forthcoming)*--enabling a comparison with the professoriate as a whole.[5] The final survey included 79 questions in 4 sections. Like the student survey it included a mix of likert-scale questions and open-ended questions.

All faculty teaching courses in the seven projects during the Spring 1993 term were sent questionnaires. Distribution was timed so that all faculty would receive the questionnaire prior to the end of the term. A total of 40 questionnaires were sent to faculty, 31 were returned for a total response rate of 78 percent. Comparisons of faculty responses across projects were not possible

[5] Results from the *1992 National Survey of Postsecondary Faculty* are not yet available.

for two reasons: (1) to protect the confidentiality of participants, and (2) because only a small number of faculty from each project were included in the sample.

Survey Results

The following discussion of the survey results focuses on two areas that are of particular concern to college and universities that serve "new majority students" and/or that operate technology delivered learning programs. First, we discovered several differences between the responses of off- and on-campus students that may assist colleges and universities design more effective means of delivering academic support and student services to "new majority" students. Second, faculty and students responded to several sets of questions designed to measure how these technologies effect class dynamics. It is frequently assumed that technology delivered courses lack meaningful interaction between students and faculty, and among students. Responses by faculty and students in the New Pathways program may help to dispel that myth.

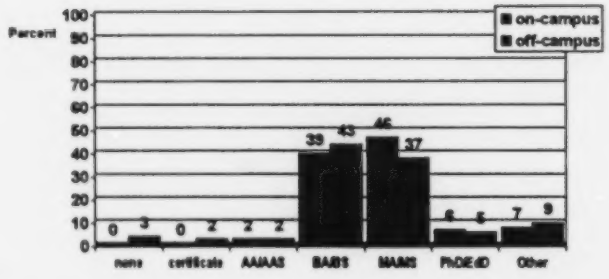
The "New Majority" Student

Providing academic and student services to students studying at off-campus presents admissions officers, academic advisers, and student service administrators with a unique challenge. On-campus facilities designed to meet the needs of the on-campus student--the counseling center, registrar, student union, library, and other facilities--are not accessible and may not be as useful to the "new majority student" studying at a distance. One of the first issues institutions must deal with when serving these students is what information and services they need, and how to make these services available to them.

Distance from campus is not the only reason students have for choosing to study off-campus. In general, off-campus students participating in the New Pathways program tend to be involved in several things at once; including working a full-time job and raising a family. In the programs which serve rural populations, off-campus students (68 percent) tend to live further--20 miles or more--from campus than on-campus students (26 percent) However, in the programs which serve urban populations, off-campus students (83 percent) are more likely to live closer to campus--within 20 miles--than on-campus students (26 percent). Convenience, not distance, seems to be the single greatest reason these students choose to take a course via technology. Indeed, the most common response given by all of the off-campus students when asked about the advantages of taking a technology delivered course was that it was offered at a convenient time or location, or allowed them to complete course work at a pace and at times they controlled.

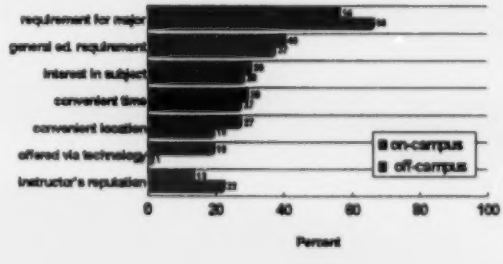
In many ways the off-campus students are more motivated than the on-campus students. The off-campus New Pathways' students are ambitious and expect to succeed. Off-campus students anticipate receiving higher grades than do the on-campus students. Ninety-three percent of off-campus students say they expect to receive a B or better in "this course", compared to 84 percent of on-campus students. Further, most of these off-campus students see a two-year degree or certificate as an immediate goal, not necessarily a final stopping place. While off-campus students are less likely to say they expect a degree from "this institution", almost equal percentages of off- (94 percent) and on-campus (98 percent) students eventually expect to complete at least a bachelor's degree (see Figure 1).

Figure 1
New Pathway's Student Survey
Highest Degree Expected from Any Institution
On-campus and Off-campus Students



Technology is viewed by these students as a tool which enables them to achieve their educational objectives. In general, they were always more positive about technology than were on-campus student. Less than 5 per cent of the off-campus students "disliked" any of the specific technologies. And, with the exception of voice-mail, a majority of off-campus students said they enjoyed using each of the technologies and would take another course that used them.
Off-campus students (19 percent) also are more likely than on-campus students (1 percent) to say they chose this course because it was "offered via technology" (see Figure 2).

Figure 2
New Pathways' Student Survey
On-campus and Off-campus Students
Decided to Take This Course Because:



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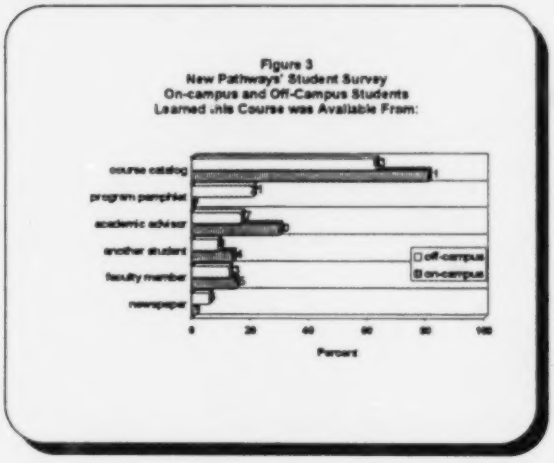
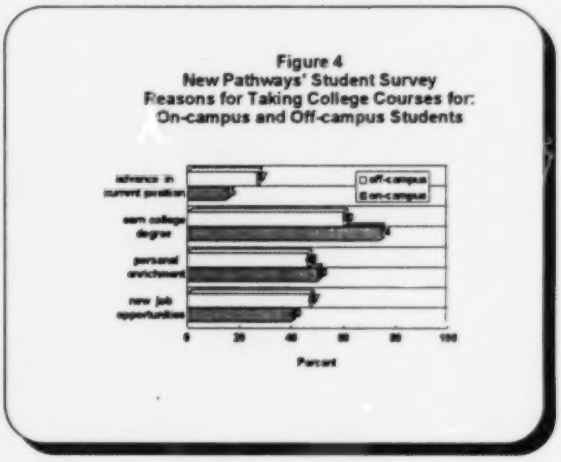
In some respects off-campus students did not vary much from on-campus students. Only the off-campus students learned about courses from the program pamphlet and the newspaper. However, the majority of off- (63 percent) and on-campus (81 percent) students say they learned about the availability of this course through the college catalog (see Figure 3). Further, while more off- (27 percent) than on-campus (15 percent) students reported that the they decided to take courses at this time "to advance in their current position", majorities of both groups (58 percent off-campus; 74 percent on-campus) say they are taking courses because they want to "earn a college degree" (see Figure 4).





Class Dynamics

These projects presented us with the unique opportunity to evaluate the perceived effects of various instructional technologies on the "classroom" experience. There is more to a college course than absorbing the words of a faculty member. A critical part of any effective college course is the opportunity for students to discuss ideas among themselves and with the faculty. Indeed, much of the literature on learning emphasizes the importance of actively engaging students in the learning process (Cheney, 1990; Task Group on General Education, 1988; Faculty Teaching Excellence Program, 1988; Boyer, 1987; Newman, 1985; Study Group on the Conditions of Excellence in American Higher Education, 1984).

To measure the perceived effects of each of these technologies on class dynamics students and faculty were asked about the **quality** and **quantity** of interaction and the usefulness of each technology to learning the subject matter in "this course." Students and faculty were asked to compare their experiences with faculty/student and student/student interaction in "this course" with , those they have had in previous face-to-face classes. It should be remembered that this is a measure of perception only, and that there is no control for the diversity of prior experiences students and faculty have had in their face-to-face classes. Nevertheless, it does give us some insight into the way students and faculty perceive their interactions in technology medicated courses.

Student/Instructor Interactions. The anecdotal evidence gathered by the site evaluation team suggested there may be both quantitative and qualitative differences between mediated and face-to-face interaction in these courses. Therefore, we asked the students about both the **quality**

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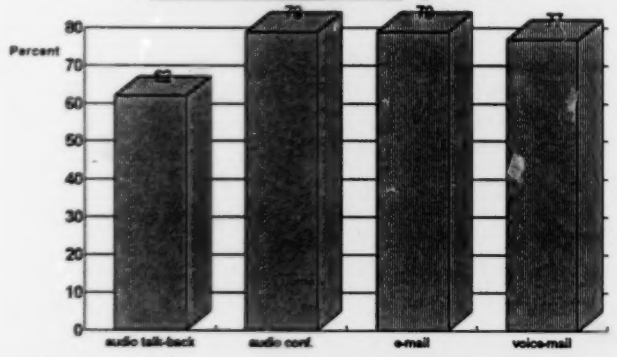
and **frequency** of their interactions with their instructor. Overall the students thought that the **quality** of their mediated interaction was at least as good as, or even better than, the experiences they had in face-to-face classes. It also is interesting to note that approximately one-half thought the **frequency** of their interactions were the same as, or more frequent than those in a face-to-face situation.

Of course, students reacted to these questions differently depending on the type of technology in question.[6] More than three-fourths of the students rated the **quality** of interaction with their instructor using audio conferencing, electronic mail, and voice-mail as equal or superior to face-to-face classes, compared with only 62 percent of those using audio talk-back (see Figure 5). Moreover, more than one-half (57 percent) using electronic-mail, nearly one-half (48 percent) using audio-conferencing and voice-mail, and approximately two-fifths (44 percent) of those using audio talk-back rated the frequency of their interaction with the instructor as the same or more frequent than in previous face-to-face courses.

Figure 5
New Pathways' Student Survey
Compared to Face-to Face Classes,
Quality of Interaction with *Instructor*
is Unchanged or Improved by use of:



Since the respondents to each technology section are for all practical purposes separate samples, the only way to evaluate the significance of the difference between reactions to audio talk-back and the other technologies was with a nonparametric chi-square. We tested the assumption that if the type of technology has no effect on student/faculty interaction the distribution of responses to **frequency** and **quality** of interaction for electronic-mail, voice-mail, and audio-conferencing would be equal to the distribution of responses for audio talk-back. The sample size for voice-mail was too small to yield statistically meaningful results, and the difference between responses regarding the **frequency** of interaction with audio-conferencing and audio talk-back was not statistically significant. However, the perceived **quality** and **frequency** of

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[6] This analysis includes comparisons between four of the five interactive medium included in the evaluation: Audio talk-back, audio conferencing, electronic-mail, and voice-mail. Due to a small sample size and poor response rate an analysis of responses regarding the use of two-way video are not included. Only two two-way video courses were being offered at the seven projects, and one course was dropped from the analyses due to a poor response rate.

interaction with faculty was statistically significant at the .001 level with chi-squares of 56.9 and 11.8, respectively.

If one considers the behaviors involved in using these different technologies, these differences in the student's reactions are not surprising. Audio talk-back is the aspect of a one-way video, two-way audio set-up designed to allow students to communicate with an instructor they can see and hear but who cannot see them. The first group of technologies (electronic-mail, voice-mail, and audio-conferencing) each requires some planning on the part of the instructor that is aimed specifically at facilitating interaction with his/her students. Audio talk-back is typically used in conjunction with a televised lecture. This means there may, or may not, be any rethinking of the way in which interaction is accomplished between the instructor and the students. This same argument holds true for two-way video classes. While the responses we have from students using two-way video is insufficient to be included here, they do seem to be closer to the audio talk-back responses than those relating to the other technologies.

Electronic mail is the only technology for which more than one-half of students rated the **frequency** of interaction equal or superior to face-to-face classes. This again may be a function of the behaviors associated with the use of these technologies. In a face-to-face class, each student competes for the chance to interact with the instructor during a limited amount of time. The same is usually true in an audio-conferencing environment. Even though voice-mail and electronic-mail are free from time constraints, only electronic-mail gives instructors and students the flexibility to think about and compose a detailed message. For users of electronic-mail, this may encourage more frequent, high quality exchanges.

To determine whether the instructors and the students were equally satisfied with the capabilities and practices of interacting with one another via technology, we also asked the faculty to compare their mediated experiences with those in the same classes they had taught in a face-to-face environment. They were asked to rate both the **frequency** and the **quality** of interaction. We also asked them to write their answers to the question: "What differences have you noticed between the **frequency** and **quality** of interaction in courses using instructional technology versus more traditionally taught courses."

Interestingly, the faculty's perceptions and the students' don't agree. While the students thought the **quality** of interaction with their instructors was unchanged or improved *least* often with one-way video/audio talk-back technology, the instructors rated the quality of their interactions with students highest with one-way video/audio talk-back technology. One hundred percent of those using one-way video with the audio talk-back component thought their interactions with students was at least the same as that they experienced in face-to-face classes. This tends to support an earlier argument that faculty need not radically rethink how they teach their class when they use this technology and consequently perceive it as about the same. Whereas the other three technologies require that faculty consciously change their teaching strategies. These other technologies still rated very high with regard to the quality of interaction being considered as good as, or better than the face-to-face class experiences[7] (see Figure 6).

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[7] The number of faculty responding to questions about each of these technologies is about the same (8 to 15 each).

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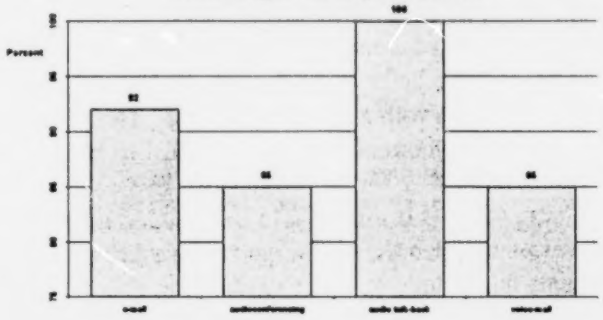
Figure 6
New Pathways' Faculty Survey
Quality of Interaction with Students Compared to Face-to-Face Classes is *Unchanged or Improved* for:



In response to the open-ended question several faculty mentioned changes in the mode of interaction without really commenting on how it was different. For example, according to one instructor, "[s/he] spend[s] more time interacting on the phone and in writing than in person." Others reflect the qualitative effect of the media. The following examples are characteristic of the responses from faculty using real-time video as the primary means of communicating with students:

- "The discussion stays on task on the air. No digressions. The listening skills improve since students focus more on the call-in comments."
- "Students need greater encouragement to offer feedback to instructor."
- "Interaction is less spontaneous."
- "There is much less interaction. Students call voice mail with questions."
- "It was much easier to initiate the interaction in a classroom course than a televised lecture course."

These are the same types of comments that instructors using this technology have been making for the past ten years. This is probably why many institutions are going beyond the "on the air" interaction as the only means for communication. Faculty using other technology (such as, electronic-mail, voice-mail and audio-conferencing) to interact with their students say things like:

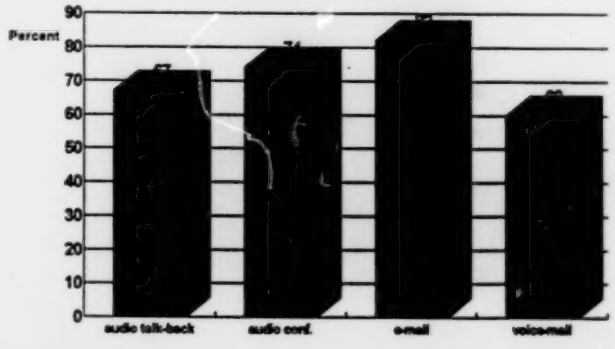
- "Role of instructor changes from being all info/concept provider to greater emphasis on working with students to use the info/tech."
- "I have greater awareness of the individual students and his/her individual learning styles."
- "I never felt 'connected' with the students, mostly because I spent so much time energy and 'stress' attempting to understand the computer."

- "Quality - more in-depth, one-on-one... This [e-mail] does force an instructor to address the individual differences. It is more obvious that learners are at all different levels of achievement... Electronic *group* interaction can never replace the face-to-face situation."
- "Phone lines are not great for assessing pronunciation. On the other hand, the students receives feedback on every word they write or speak -- highly personalized feedback."
- "Voice mail does give students unlimited access to instructor."

These comments are characteristic of the faculty responses. They highlight the differences between what students and faculty do when they communicate using voice-mail, electronic-mail, or audio conferencing. These technologies offer more intimate channels of communication, but also require that faculty learn new skills, and invest more time in course preparation. As a result, they tend to change the teaching/learning environment more radically than do video-based technologies.

Student/Student Interaction. As previously mentioned, a good quality learning environment should include more than just information exchanged between the student and the faculty member. The college student on a campus also learns from his/her peers and from the opportunity to discuss new ideas. We wanted to know if any of these technologies seemed to be a superior tool for this function. It is interesting that even though more than one-half of the New Pathway students thought the **quality** of electronic-mail (82 percent), audio-conferencing (74 percent) mediated interactions were at least as good as face-to-face classes for student to student interactions, while a somewhat smaller percent (67 percent) thought audio talk-back was. The reason this is interesting, is that audio talk-back technology is usually used in a peer group setting. That is, groups of students gather at remote sites to participate in the televised class session. Under most circumstances, voice-mail, audio conferencing, and electronic mail are used by isolated students, yet they still appear to provide adequate opportunities for peer interaction (see Figure 7).

Figure 7
New Pathways' Student Survey
Compared to Face-to Face Classes,
Quality of Interaction with *Other Students*
is Unchanged or Improved by use of:



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Other Changes in Class Dynamics. Faculty were asked two questions specifically about differences in class dynamics between New Pathways courses and traditionally taught courses: (1) Were there differences in the classroom dynamic?, and (2) To what do you attribute those differences? These responses are among the most difficult to generalize. There seem to be differences attributable to institutions, to technologies used, to individual teachers, and to students. One response may appropriately set the tone for this discussion:

> "I don't believe this is a good or necessary comparison. This is a different means of learning; it works for some students and not for others. Making this comparison for my course doesn't accomplish anything."

Faculty had very different responses to the issue of changes in class dynamics. Those who were positive about the changes in classroom dynamics mention being better prepared, having better graphics, the greater variety of supporting materials, the superiority of graphics presented by the new technologies as compared to the overhead projector, that students are less inhibited, that there is more interaction, and that they get more information on how students are performing. Those who were negative about the changes in classroom dynamics mention that students are generally more hesitant to interact and tend not to attend class sessions (they may be available on videotape for later viewing), some students become more invisible (others are drawn in), there are fewer questions, more lecture, more structure, less free inquiry, less fun, there is no comparison between face-to-face and television.

In general the improvements are caused by the demands of the technologies--to be better prepared, to have thought through the instructional strategy from beginning to end, and to have found and presented the appropriate materials needed to support the course. The negative impacts on the course dynamics on the other hand are caused by the distance between student and teacher and by personalities of both teachers and students.

Limitations Of The Evaluation Process

One of the most obvious limitations of this evaluation is that the students taking these New Pathways courses are self-selecting. These were students who had reasons for not being on a campus, yet were motivated to seek out educational opportunities. They had high expectations of themselves, were serious about their studies, agenda oriented, and grateful for the opportunity to have access to a college education. Consequently, they were willing to try new experiences and successfully cope with the difficult time-management commitments required. Although information on course retention rates is available from only a few of the projects, their data suggest that course completion rates were very high (90 percent or higher).

These students also may be naturally high achieving individuals, with previous experiences that shaped their interest in technology-based instruction. Since we had no way of controlling from previous educational or technological experiences, we don't know how the skills and experiences they brought with them influenced their perception of this experience.

Although the faculty also seem to be self-selecting, at least some instructors indicated they were teaching the course because it was required of them. Nevertheless, the sample size is too small to make generalizations from the faculty responses.

Finally, time constraints made it impossible to conduct follow-ups to see how this experience affected students and faculty in subsequent courses, at work, or in other activities.

However, to varying degrees, on-going evaluation processes were initiated at each of the seven projects. While they do not provide consistent and comparable cross-project information, they will provide some longitudinal information on the experiences of students involved in these distance learning projects.

Summary And Conclusion

This discussion has covered only a small part of the two-year evaluation of the seven Annenberg/CPB's New Pathways to a Degree projects. Nevertheless, the material presented here suggests that New Pathways students and faculty, in general, responded very well to all the technologies examined here. Even though we may not be able to generalize the responses of the New Pathways students to all potential college students, their responses have helped us learn a little about what types of technologies seem to work best for different types of tasks that are typically part of the "student experience" on- or off-campus. If a faculty member wants to "deliver" a lecture to a group of students via any of the video technologies (two-way video, one-way video with two-way audio, broadcast video, videotape) that seems to be acceptable to students studying off-campus. If the faculty member wants to have interaction with students or between students, then the video technologies seem less effective than all the other technologies used in these projects. According to the students, audio-conferencing, electronic mail, or voice-mail work equally well for student/faculty discussions. For student to student discussions electronic-mail seems superior.

Most surveyed New Pathways faculty thought the technologies that let them act the same way they do in face-to-face classes provided the best tools for interaction. It is interesting to note that several faculty members surveyed indicated that the experience of mediated teaching does not compare at all with a face-to-face environment. It also is critical to note that all these faculty represent the first generation using these new tools and the tools themselves are pushing changes in the relationship between course content, mentor, and the student. One faculty member even mentioned that he felt more like a mentor than a teacher. The tools themselves and the pedagogy surrounding them are evolving. It is hard to tell right now how all this can work and will work in the near future, but we do know that the technologies used in these seven projects all worked for most of the students who used them.

The lessons learned from the New Pathways evaluation may be of use to other institutions exploring the benefits and costs of instructional technology programs. Although the literature on educational assessment is voluminous, the assessment of technology-based instructional programs is still in its infancy. A variety of assessment inventories are available for assessing satisfaction, educational and social behaviors, and perceptions of outcome.[8] Unfortunately, all of these

[8] The Clearinghouse of Higher Education Assessment Instruments (1993) lists hundreds of instruments designed to measure everything from cognitive abilities and skills to affective measures such as feelings about interpersonal relations and values. Among these are: the Learning and Study Strategies Inventory (LASSI) designed to assess strategies and attitudes successful students use in learning (NCHEMS, 1993); the Motivated Strategies for Learning Questionnaire (MSLQ) containing self-reported items addressing student beliefs about themselves and how they work (NCHEMS, 1993); The College Student Experiences Questionnaire (CSEQ) and Community College Student Experiences Questionnaire (CCSEQ) includes measures of involvement in college activities (social and educational) and self-reported learning practices (Pace, 1990); The National Center for Higher Education Management Systems' inventory includes questionnaires designed to measure staff and faculty values; the impact of the college experience on alumni; and the educational goals and satisfaction with services of entering, continuing and completing students, and alumni (NCHEMS, 1994); the American College Testing Service's inventory includes instruments measuring student satisfaction with services and the campus environment,

inventories start with the basic assumption that the respondents are participating in a traditional classroom experience. For example, the College Student Experiences Questionnaire (CSEQ) includes several sections on college activities that are relevant for both students in traditional classroom settings and those in technology-based or distance learning environments (including Library Experiences, Experiences with Faculty, Course Learning, Experience in Writing, and Science). However, because it is designed with the traditional classroom experience in mind, items are frequently included that are inappropriate or meaningless for technology-based courses. For example, students are asked how often they "took detailed notes in class" or "read something in the reserve book room or reference section" (Pace, 1990). Other questions relevant to the technology-based course are omitted, such as how often students "communicated with faculty and/or other students via E-mail", "requested that a book be mailed to you from the library via computer", or "participated in an audioconference with other students". Similar problems exist with each of the other assessment inventories.

Since the student experience and the terminology used in technology-based courses are specific to that context, institutions that want to assess these programs must create their own assessment instruments. While these may be uniquely suited to the institutions needs, the institution has no way of comparing their programs or students with other programs and students at other institutions. Nor does it give us a means for generating normed responses that enable comparisons of different models of instructional technology use. Clearly more work needs to be done in the assessment of technology-based instruction.

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and self-reported measures of academic achievement (ACT, 1994); and the Educational Testing Service's Program Self-Assessment Surveys assess satisfaction with and evaluation of the college environment for students, faculty, and alumni (ETS, 1994).

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